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THE OHIO STATE UNIVERSITY
COLLEGE OF EDUCATION
GEORGE F. ARPS, *Dean*

ARRANGEMENTS for the programs of the Eighth Annual Ohio State Educational Conference are practically completed. Many speakers of national repute have already been secured, while negotiations are still in progress with a number of other outstanding educators. A glance at the list of those who have accepted the invitation to be present convinces one of the increasing national scope of the Conference.

At the general sessions the delegates will have an opportunity to hear President Glenn Frank, of the University of Wisconsin—already known to a large number of the teachers of Ohio—and President Emeritus William O. Thompson, of Ohio State University, who always has a worthwhile message for his hearers. Other nationally-known speakers and the sections which they will address include:

Superintendent John J. Maddox, St. Louis, and Superintendent William McAndrew, Chicago—City Superintendents' Section.

Herman Alder, Juvenile Psychopathic Institute, Chicago—Clinical Psychology and Special Education Section.

R. L. Lyman, University of Chicago—English Section.

John R. Clark, New York University—Mathematics Section.

Charles Farnsworth, Teachers College, Columbia University—Music Section.

V. A. C. Henmon, University of Wisconsin—Educational and Intelligence Tests and Teacher-Training Sections.

E. G. Blackstone, University of Iowa—Commercial Education Section.

L. C. Marshall, University of Chicago—History Section.

A. T. Walker, University of Kansas—Latin Section.

Lee Driver, State Department of Pennsylvania—County Superintendents' and Village and Consolidated-School Superintendents' Sections.

At Columbus, April 12, 13, 14 *Reserve the dates*

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Educational Research Bulletin

RELATION OF INTELLIGENCE SCORES TO HIGH-SCHOOL AND UNIVERSITY MARKS

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St. Louis
AND
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The State University of Iowa, in the summer of 1920, authorized an intelligence test for entering Freshmen in liberal arts and pharmacy. The Thorndike Intelligence Examination for High-School Graduates was used—Part I, Forms E and F; Part II, Form C; and Part III, Form B. In the fall of 1921, Part I, Forms J and K, and the Iowa Comprehension Test, Beta 1, were given to Freshmen in the same courses. The data presented in this discussion have particular reference to the latter tests.

Relation of university and high-school marks to intelligence.—The data on high-school and university marks were obtained from the registrar's office, while the intelligence scores were made available through the courtesy of Dr. Wilhelmina Koerth, who had charge of the testing. To limit the number of cases considered, a sampling of every third one of the 1,046 Freshmen was taken. Since only those were considered who completed the academic year of 1921-22, many were eliminated, and the number was reduced to 266—107 girls and 159 boys.

The university letter-marks earned by each were averaged and transferred into numerical values by means of the registrar's system used in awarding prizes and honors. The high-school marks were taken from the transcripts on record in the registrar's office and only those subjects on which the University allowed entrance credit were included. About 75 percent of the high schools represented used the percentage system of grades, and in such cases an average was sufficient. For those using letter marks, numerical values were assigned on the basis of the passing mark, which in all cases was given in percent, and the number of steps in the system.

A passing grade in the University was 62 percent, while in most of the high schools it was 70 and 75 percent. To make the two groups comparable, it was necessary to devise a scheme of interpretation. This was done on the basis of the range between the passing grade and the highest grade given. For the University, the range was from 62 to 98 percent, or 36 percent, while for the high schools it was from the passing grade to 100 percent. If the passing grade of a high school is 60 percent, its range would be 40 percent. Therefore, 40 percent in the high school equals 36 percent in the University, or 1 percent in the high schools equals .9 percent in the university scale. The scale is given in Table I.

Consider, for example, the case of a student whose average is 80 percent, or 5 percent above passing, and who comes from a high school where the passing mark is 75 percent. Referring to Table I, in this group 1 percent in high school equals 1.4 percent in the university scale; therefore, that student is 7.2 percent (5 x 1.4) above passing. His interpolated mark is 75 plus 7.2 or 82.2 percent. By applying this technique in which the range is the criterion of value, the high-school and university marks are made comparable.

TABLE I

SCALE OF MARKING

High-School Passing Grade (Percent)	Range of Marks above Passing (Percent)	Ratio of University Marks to High-School Marks
(1)	(2)	(3)
60	40	.9
65	35	1.0
70	30	1.2
75	25	1.4
80	20	1.8

Taking the group as a whole, three correlations were made.[1] These were:

	Correlation Coefficient
High-school marks and intelligence scores	.42 ± .036
High-school and university scores	.55 ± .319
University marks and intelligence scores	.44 ± .358

As a prognostic instrument of university success, high-school marks are more significant than the intelligence scores on which this study is based. The correlations found here between university marks and intelligence closely agree with the result obtained by C. L. Stone, of Dartmouth College, who correlated the freshmen marks with Alpha scores for the first semester in 1919 and in 1920 with the following respective results: $r = .438 \pm .22$ and $.498 \pm .021$.[2]

Comparison of marks and intelligence of boys and girls.—On the basis of the interpolated marks, the means and standard deviations were calculated for the entire group, and the means were obtained for boys and girls separately for the three headings. These are shown in Table II.

The larger standard deviation found under intelligence is due partially to the greater range of this measure which extends from 33 to 111, or 78 points,

TABLE II

MEANS FOR THE UNIVERSITY, HIGH-SCHOOL, AND INTELLIGENCE MARKS

Marks	Mean			Standard Deviation for Entire Group
	Boys	Girls	Entire Group	
(1)	(2)	(3)	(4)	(5)
University	74	78	75	.925
High-school	72	82	76	.676
Intelligence	71	72	72	1.656

while, in the high-school marks, the range extends only from a passing mark to 100. This, in a large majority of the schools, would be from 25 to 30 points. A similar condition obtains in the university marks.

A comparison of the scores of the girls and boys shows no significant difference in intelligence, but a marked difference in favor of the girls in the means of both university and high-school marks amounting to 4.4 percent in the university marks and 10.2 percent in the high-school marks. No explanation is here offered for this difference, but reference may be made to Dr. Koerth's dissertation in which nine assumptions given might partially explain this difference.[3]

[1] The Ayres method of correlation (see Ayres, Leonard P., "Shorter Method for Computing the Coefficient of Correlation," *Journal of Educational Research*, 1:216-21, March, 1920) was used. This method agrees very closely with the Pearson product-moment formula.

[2] Stone, Charles Leonard. "Disparity between Intelligence and Scholarship," *Journal of Educational Psychology*, 13:241-44, May, 1922.

[3] Koerth, Wilhelmina. "Some Aspects of the Intelligence Rating of College Students." On file at the Library of the University of Iowa.

STATISTICAL CHECKS ON THE ACCURACY OF INTERCORRELATION COMPUTATIONS

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Ohio State University

THE adding-machine method of computing intercorrelations of tests has previously been pointed out to be a most efficient one.[1] However, the method does not have as wide use as its excellence justifies, due largely to the fact that, after having completed a group of intercorrelations, one frequently has a feeling of uncertainty in regard to whether the several quantities entering into the correlation computations were originally correct or not.

There is, therefore, both in the above case and in the case of other computations of intercorrelation coefficients, a need for checking formulas which will enable one, with no repetition of the work, to know upon completion of the computations whether the basic quantities are correct or not. If the basic quantities, ΣX, ΣY, ΣXY, ΣX^2, ΣY^2, are correct, then the tabular arrangement for solution of the intercorrelations given in Figure 2 of the reference just cited, enables one, with a minimum of time and a perfection of accuracy, to determine and check the intercorrelations themselves. The check equations will be found to apply in a great many situations other than the present one.

The data are entered into a cross-section book (which has its binding at the left-hand side), as close as possible to the left-hand edge of that sheet which, in Figure 1, is labeled "page 1."[2] If the gross scores are small in magnitude, the original data are entered as they are, but if large in magnitude, they are first transmuted to small numbers by means of tables.[3] In Figure 1, the original data of Tests 1, 2, 3, 4, and 5 are entered as bold-faced numbers on page 1. This page is used for cumulative summations of the individual's several scores.

THE CHECKING FORMULAS

The three checking formulas, or variations of these three, used in this article are all derived from the following basic concept:

$$X_A = X_1 + X_2 + X_3 + \ldots + X_n \ldots (1)$$

in which X_A is the sum of individual A's scores on all the separate tests; and X_1 is individual A's score on Test 1; X_2, his score on Test 2, and so on.

Squaring the above expressions we obtain a second formula,

$$(X_A)^2 = (X_1)^2 + (X_2)^2 + \ldots + (X_n)^2 + 2(X_1X_2) + 2(X_1X_3) + \ldots + 2(X_{n-1}X_n) \ldots (2)$$

The third basic equation may be stated in the general form,

$$X_1(X_2 + X_3 + \ldots + X_n) = X_1X_2 + X_1X_3 + \ldots + X_1X_n \ldots (3)$$

All of these three checks will refer to individual A's several scores, and if both sides of the equation are derived *independently* the two sides of each equation must check for each individual. These same checks will obviously apply to *a number of individuals collectively*, provided we merely summate each of the above expressions over the range 1 to N, thus adding up like components

[1] Toops, H. A. "Computing Intercorrelations of Tests on the Adding Machine," *Journal of Applied Psychology*, 6:172–84, June, 1922.

[2] Note how the successive leaves on the right are clipped off in index fashion so as to allow the total columns—Columns 22, 26, 29, 30, 31—to show and in order to enable the addition of all such totals from the successive pages for any given person. The XY extensions for variable 1 may take all of the back of page 2 and the front of page 3 (not shown) if necessary. Pages 2, 3, 4, 5, 6 may be creased and folded vertically, as necessary, in order to bring them into closest possible proximity to the columns being worked upon.

[3] *See Op. cit.*, p. 175.

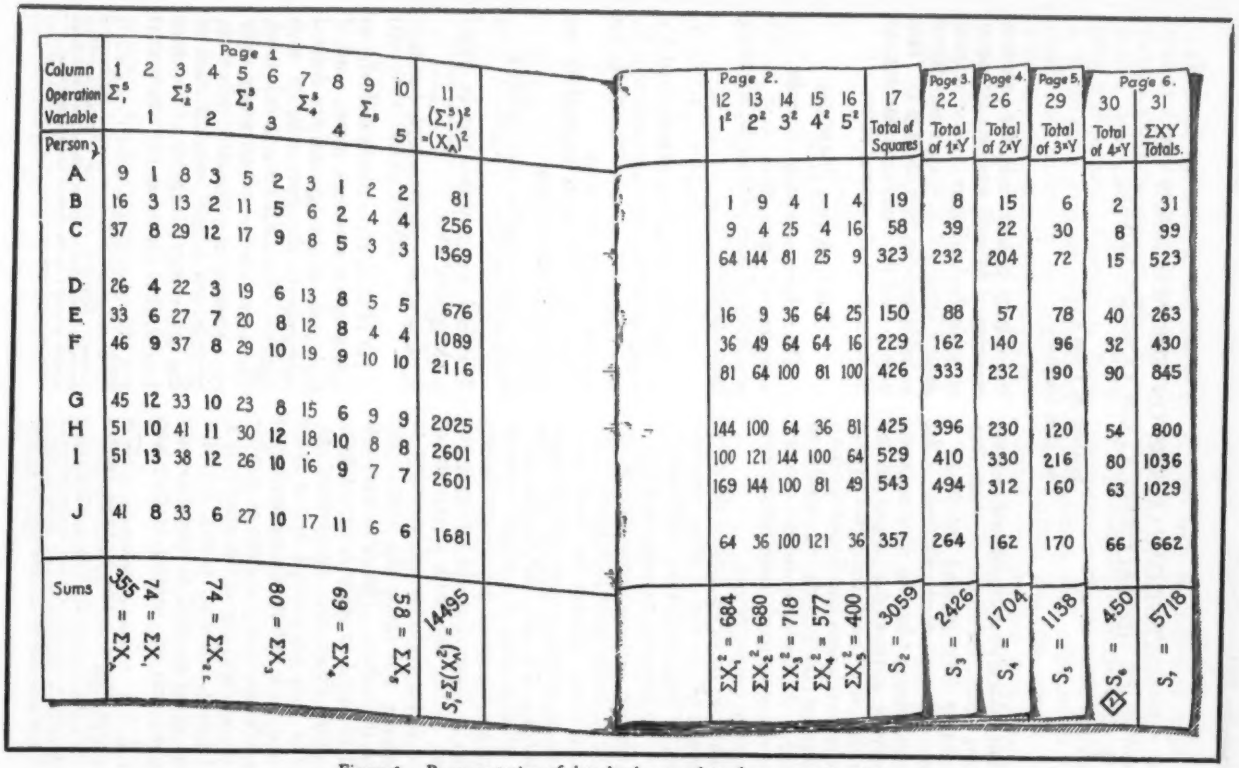

Figure 1. Representation of data book opened to show pages 1 and 2

for all individuals and so treating the group as though it were an individual. The equations thus resulting are:

$$\Sigma X_A = \Sigma X_1 + \Sigma X_2 + \Sigma X_3 + \ldots + \Sigma X_n \ldots (4)$$

$$\Sigma(X_A)^2 = \Sigma(X_1)^2 + (\Sigma X_2)^2 + \ldots + \Sigma(X_n)^2 + 2(\Sigma X_1 X_2) + 2(\Sigma X_1 X_3) + \ldots + 2(\Sigma X_{n-1} X_n) \ldots (5)$$

$$\Sigma X_1 (X_2 + X_3 + \ldots + X_n) = \Sigma X_1 X_2 + \Sigma X_1 X_3 + \ldots + \Sigma X_1 X_n \ldots (6)$$

DETAILED STEPS IN SOLVING INTER-CORRELATIONS WITH CHECKS

The method described below gains in efficiency provided the data are arranged in carefully prepared order in a cross-section book arranged after the following fashion:

1. Transmute the gross scores if not previously transmuted.
2. The names or code numbers of the several persons should be put in the zero column at the left of the page. It is preferable to block off horizontal divisions by leaving blank lines after every three or every five names.
3. Enter on page 1 of the book—as shown in Figure 1—in Columns 2, 4, 6, 8, and so on, in black carbon ink, the scores of Tests 1, 2, 3, 4, and so forth respectively, leaving Columns 1, 3, 5, 7, and so on blank.
4. On page 2, a right-hand page of the book facing page 1, clip off as many columns from the right-hand side of the page as there are different tests, n. On page 3, the next right-hand page upon turning the sheet, clip off as many columns at the right-hand side of the page as there are tests less 1, $(n-1)$; on page 4, the next right-hand sheet of the book, clip off as many columns at the right-hand side of the page as there are tests less 2, $(n-2)$, and so on. If properly done the extreme right-hand column of pages 2, 3, 4, 5, and so on will be visible from page 2, when the book is opened at pages 1–2, and the sub-totals from these separate pages can thus be added in a horizontal row for each person without the necessity of thumbing through the book and hunting out separately the figures for a given individual.
5. Label the several columns of page 2 as shown in Figure 1, "$(X_1)^2$, $(X_2)^2$, $\ldots\ldots(X_n)^2$, Total." In Figure 1, these are given merely as 1^2, 2^2, 3^2, 4^2, 5^2. Take care that the total column is the column at the extreme right, next to the cut just made, so that an entry in the total column will appear on the border at the right.
6. Label page 3, as shown in Figure 2,[1] with the proper headings depending on all the possible intercorrelations of Test 1 with the remaining tests namely, "$X_1 \cdot X_2$, $X_1 \cdot X_3$, $X_1 \cdot X_4$, $\ldots\ldots$, X_1, X_n, Total."

   Use page 4 for the intercorrelations of variable 2 in similar fashion; page 5 for the intercorrelations of variable 3 with the remaining tests; and so on. The last page will contain but one heading, the correlation of the $X \cdot Y$ products for $X_{n-1} \cdot X_n$ which in itself will be a total, and consequently can be checked only by carefully doing it over in reverse order. This last page will be so cut that two columns will appear when the book is opened at page 1—the total just mentioned and a second column at the extreme right labeled "$\Sigma X \cdot Y$ totals."[2] From this point forward the steps deal with the actual work of making the required extensions which are involved in obtaining the basic quantities, referred to before, or in securing the checks made possible by this method. It is

[1] The pages are represented as having been torn out of the book, the blank paper on the left of each successive sheet having been clipped off, and then all placed side by side to save space. All entries for a given person will be found on a given horizontal row.

[2] It will be noted that this method wastes a large amount of paper inasmuch as the sheet which, after cutting, is narrowest in width contains the maximum amount of work, whereas the sheet which is largest in width contains the minimum amount of columns in computation. Paper is so exceedingly cheap, however, as compared with human labor required in covering it with figures, that the use of several booklets to secure one's correlations is in reality a great convenience.

Figure 1. Representation of data book opened to show pages 1 and 2

	Page 1.											Page 2.						Page 3					Page 4.				Page 5.			Page 6.	
Column	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Operation	Σ_1^5		Σ_2^5		Σ_3^5		Σ_4^5		Σ_5		$(\Sigma_1^5)^2$	1^2	2^2	3^2	4^2	5^2	Total of	1×2	1×3	1×4	1×5	Total	2×3	2×4	2×5	Total	3×4	3×5	Total	Total	ΣXY
Variable	1		2		3		4		5		$=(X_A)^2$						Squares					of $1\times Y$				of $2\times Y$			of $3\times Y$	of $4\times Y$	Totals
Person																															
A	9	1	8	3	5	2	3	1	2	2	81	1	9	4	1	4	19	3	2	1	2	8	6	3	6	15	2	4	6	2	31
B	16	3	13	2	11	5	6	2	4	4	256	9	4	25	4	16	58	6	15	6	12	39	10	4	8	22	10	20	30	8	99
C	37	8	29	12	17	9	8	5	3	3	1369	64	144	81	25	9	323	96	72	40	24	232	108	60	36	204	45	27	72	15	523
D	26	4	22	3	19	6	13	8	5	5	676	16	9	36	64	25	150	12	24	32	20	88	18	24	15	57	48	30	78	40	263
E	33	6	27	7	20	8	12	8	4	4	1089	36	49	64	64	16	229	42	48	48	24	162	56	56	28	140	64	32	96	32	430
F	46	9	37	8	29	10	19	9	10	10	2116	81	64	100	81	100	426	72	90	81	90	333	80	72	80	232	90	100	190	90	845
G	45	12	33	10	23	8	15	6	9	9	2025	144	100	64	36	81	425	120	96	72	108	396	80	60	90	230	48	72	120	54	800
H	51	10	41	11	30	12	18	10	8	8	2601	100	121	144	100	64	529	110	120	100	80	410	132	110	88	330	120	96	216	80	1036
I	51	13	38	12	26	10	16	9	7	7	2601	169	144	100	81	49	543	156	130	117	91	494	120	108	84	312	90	70	160	63	1029
J	41	8	33	6	27	10	17	11	6	6	1681	64	36	100	121	36	357	48	80	88	48	264	60	66	36	162	110	60	170	66	662
Sums	$\Sigma X_1 = 355$		$\Sigma X_2 = 274$		$\Sigma X_3 = 274$		$\Sigma X_4 = 80$		$\Sigma X_5 = 69$		$S_1 = \Sigma(\Sigma_A^5)^2 = 14495$	$\Sigma X_1^2 = 684$	$\Sigma X_2^2 = 680$	$\Sigma X_3^2 = 718$	$\Sigma X_4^2 = 577$	$\Sigma X_5^2 = 400$	$S_2 = 3059$	$\Sigma X_1 X_2 = 665$	$\Sigma X_1 X_3 = 677$	$\Sigma X_1 X_4 = 585$	$\Sigma X_1 X_5 = 499$	$S_3 = 2426$	$\Sigma X_2 X_3 = 670$	$\Sigma X_2 X_4 = 563$	$\Sigma X_2 X_5 = 471$	$S_4 = 1704$	$\Sigma X_3 X_4 = 627$	$\Sigma X_3 X_5 = 511$	$S_5 = 1138$	$S_6 = 450$	$S_7 = 5718$

$S_1 = 14{,}495$

$S_2 = \Sigma X_1^2 + \Sigma X_2^2 + \cdots\cdots + \Sigma X_5^2 = 684 + 680 + 718 + 577 + 400 = 3059$

$2S_7 = 2 \times (S_3 + S_4 + S_5 + S_6) = 2\,(2426 + 1704 + 1138 + 450) = 11{,}436$

$14{,}495 = 3059 + 11{,}436 = 14{,}495$

$14{,}495 = S_2 + 2S_7 = 3059 + 2(5718) = 14{,}495$

Figure 2. Representation of all the pages in the book

desirable to compute the correlations by making each book contain say, only twenty-five or thirty cases. This has the following features: (1) Different workers can be working on the extensions at the same time—two or more books may be worked on independently by different workers. (2) Each block of twenty-five or thirty cases stands on its own merits and when an error occurs in the work it may be detected in the small group with a consequent great saving of time. (3) If desired, one may compute his correlation coefficients cumulatively, that is, after the first twenty-five cases and then after each successive addition of twenty-five cases, and thus empirically determine a minimum number of cases which will yield stable relationships.

7. Make all the extensions called for by the headings of the several pages. For the most part the multipliers are so small that the multiplications may readily be done mentally. A prepared table of products up to 20×20 will refresh the memory in case of difficulty.
8. On page 1 add the columns vertically and record the sums at the bottom of the page. In Figure 1 the sums of 74, 74, 80, 69, and 58 respectively are properly labeled with the appropriate titles, ΣX_1, ΣX_2, ΣX_3, ΣX_4, ΣX_5 respectively.
9. In red ink *beginning with the last column on the right*, summate each of person A's scores, recording the successive summations respectively to the left of the last number included in the summation. These summations are printed in light-face type, and for individual A (in Columns 9, 7, 5, 3, 1 respectively) are respectively 2, 3, 5, 8, and 9; and for person B, they are respectively 4, 6, 11, 13, 16. The sum of all the scores of person A on the five tests is thus 9; and for B, 16. These sums are found in Column 1.
10. Summate in Column 1 the totals of all persons just obtained, and record the total at the foot of Column 1. Thus 355 is the sum of all the scores on all the tests made by all of the 10 persons.
11. Summate by columns the total scores on the several tests and enter the sums found at the foot of columns 2, 4, 6, 8, 10. The sum of the sums is $58 + 69 + 80 + 74 + 74 = 355$, and thus checks with the 355 found at the foot of Column 1. This Figure 355 is thus a single figure which checks the accuracy of all the *additions* of page 1. It is the check afforded by Formula 4. If this figure does not check, the error must be found and corrected.
12. Square the entries found in Column 1 and enter them person by person in Column 11. The sum of these entries in Column 11 is 14,495. This figure will be ultimately used as a check on absolutely all computations contained on this and all subsequent pages of the one book. This sum hereafter will be referred to as S_1.
13. On page 2, obtain for each person a horizontal total of his entries of that page and enter these in Column 17. The entry, 19, for person A in Column 17 is found by the simple procedure of adding up the scores for person A to the left, namely, $1 + 9 + 4 + 1 + 4 = 19$.
14. Add up vertically each of Columns 12–17 inclusive, and enter the sums at the foot of the columns with their proper labels, ΣX_1^2, ΣX_2^2, ... ΣX_6^2, S_2.
15. The summation of the subtotals of Column 17 is 3059. This figure which we shall call S_2, must check with the sum of all of the sums to its left; that is, S_2 is a single figure which checks the accuracy of all the *additions* on page 2. The check is: $684+680+718+577+400=3059$.

Figure 2. Representation of all the pages in the book

16. Before adding up the A scores on page 3 obtain the expected total entries of Column 22, to be later used as a check on the calculation of XY products from page 1. Thus in Column 22 the entry, 8, for person A is obtained by multiplying A's score, 1, in Test 1 by the red summation entry, 8, *to its right*. The entry 39, the check figure for the extensions of person B on page 3, is to be found by multiplying B's score, 3, on Test 1 by the red summation figure to its right, 3 (13) = 39; similarly, 232, the check figure on page 3 for person C, is found by multiplying 8 × 29 and so on. Obtain likewise the expected totals of Columns 26, 29, 30. The entry, 15, in Column 26 for person A is the product of A's score in Test 2 times the red summation figure at its right, or 3 × 5.
17. Add up successively all A's extensions on page 3; B's extensions and so on. Thus on page 3 (Figure 2), A's extensions are 3 + 2 + 1 + 2 = 8; B's are 6 + 15 + 6 + 12 = 39. If these check up respectively to 8, 39, 232, etc., we are thus certain of the accuracy of the *extensions*. In case of lack of agreement in any person's scores, upon checking, the extensions should be made a second time and the error corrected. This is the check on the accuracy of XY extensions made possible by Formula 6. It applies in similar manner to all subsequent XY extensions, Columns 26, 29, 30.
18. Summate all the columns on page 3. Obtain in Column 22 (total column) $S_3 = 2426$, which total figure is a check on the accuracy of the *additions* of page 3.
    Note that to date S_1, S_2, S_3, check only the *additions* of the page and do not check the correctness of the original extensions. We have just above shown how Formula 6 is used to check the correctness of each individual's XY extensions of variable 1 with the other variables. The check on the *additions* of this page are that 665 + 677 + 585 + 499 should come out to the same value as the sum of Column 22, namely 2426.
19. Proceed in similar fashion with pages 4, 5, and all subsequent pages determining both the accuracy of the extensions for each individual on that page and then the accuracy of the additions of the columns. The last page will contain but one column, the extensions of $X_{n-1} \cdot X_n$.
    All the computations in this column must be carefully rechecked one or more times both as to extensions and as to additions of column. The diamond is inserted as a reminder of the necessity of this rechecking.
20. Obtain for each individual on the last page (in Figure 1, page 6) a summation in Column 31 of all of the XY subsums exposed on the successive pages. For person A these are 8 + 15 + 6 + 2 = 31; for person B, 39 + 22 + 30 + 8 = 99. The extensions themselves are covered over by the overlapping leaves, thus making the summation easy. These various totals and the ΣXY totals are all shown in Figure 2.
21. For each individual certain checks must apply; namely that for person A his total entries in Column 11 should be equal to the total in Column 17 plus two times the total entry of Column 31. If this is true, we can be certain that all of the extensions for person A have been correctly done. This check for person A is 81 = 19 + 2 (31) = 81; for B, 256 = 58 + 2 (99) = 256. If this check does not hold the error will be found on page 2 in the *extensions of the squares* (which hitherto we have not found it necessary to recheck in order to be sure of their accuracy).
22. Having applied the checks as above and having found that all entries in

Column 31 check as above indicated, find the sum of the entries in this column, namely, $S_7 = 5718$.

23. As a final check on the computations involved in the entries of the entire table, S_1 must equal S_2 plus $2S_7$. That is $14,495 = 3059 + 2$ times $(5718) = 14,495$. We thus ultimately resolve all of the checks into one simple check of one number obtained from page 1, which must check with another number, obtained from pages 2–7 inclusive. When this check holds we are certain that every extension and addition of the entire book has been correctly done. This is the check afforded by Formula 5.

We have above detailed the steps required in obtaining a single check on the accuracy of all computations in the obtaining of intercorrelation coefficients provided the intercorrelations are solved by the method outlined. The equations above may obviously be used in checking up the accuracy of all the intercorrelations solved on plotting paper or by any other of the numerous methods. The procedure in brief is as follows:

1. Add up for each person as A, the scores (or steps, if these are used) on all of his tests.
2. Square all of these sums respectively and summate. Call this sum S_1. This sum must check with the results of all the subsequent procedures.
3. Add together the sums of ΣXY products on all of the possible $n\frac{(n-1)}{2}$ intercorrelation coefficients. Call this sum S_7.
4. Find the aggregate sum of ΣX^2 on all of the variables, call this sum S_2.
5. Then $S_1 = S_2 + 2S_7$, is a final check on the accuracy of all the quantities involved in obtaining the various intercorrelation coefficients.

If this check does not hold, one then resorts to equation (6) which enables one to detect whether the intercorrelation $X \cdot Y$ extensions of variable 1 are at fault, or those of variable 2, or of variable 3, and so on. For this purpose it obviously is desirable that the transmuted data from which correlations have been plotted be recorded in all cases in the form of the data of page 1 of Figure 1.

***

A conference to discuss problems of state-wide interest in regard to teacher training was held by the State Department of Education on December 2 and 3. Invitations to attend this meeting were sent to the directors of teacher training, heads of professional departments, and instructors of education and certain liberal-art subjects at the various institutions throughout Ohio which offer courses for the training of teachers. Problems of state-wide interest were discussed among which were the following:

1. The testing program of the State Department
2. The "follow-up" of graduates of teacher-training courses
3. Professionalized subject-matter courses—their function, scope, and content
4. Aims and objectives of student teaching
5. The course in observation and participation in its relationship to courses in principles of education, methods, school management, etc.
6. The function of the critic teacher in the development of a teacher-training program
7. The specialized supervision of student teaching
8. Constants and electives in the professional requirements as outlined in Bulletin No. 3 of the State Department of Education

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F. H. Kendall, county superintendent of schools in Lake County, advises us that in the November election, bond issues amounting to $461,000 in four rural and two village districts of the county were carried. The last one-room rural school in Lake County will be abandoned at the close of the present year, according to the superintendent.

Ohio State University

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FUNDAMENTAL ASSUMPTIONS

EDUCATION is an art whose practices are often based on untried theories, opinions, and prejudices rather than scientific principles. The cultural argument, the favorite weapon of the classicist, is now wielded with equal dexterity by teachers of mathematics, science, or industrial arts as the justification for the place of their preferred subjects within the curriculum. Educators of today think with disdain of the educational practices based upon the erroneous theory that the child was but a man of short stature. Confident in the interpretation of child nature obtained from modern psychology, educators are complacently thankful that present customs are not as these earlier ones were. Such complacency is rather ill-advised, for many of our commonest practices are based on principles accepted without proof.

We assume that all-day sessions are of more benefit to the pupils than half-day sessions. What proof have we for this belief? Do we know that all-day sessions are beneficial to the health of young children? Do we know that the children of the primary grades gain more by having "reserved seats" than by attending school half the day? The evidence gathered in the study of half-day sessions in the first two grades at Detroit did not give an unequivocal answer to these questions, for only 58 percent of pupils who attended half-day sessions made scores in reading which were less than the average score gained by those who attended the full session.

The size of classes has been used as an excuse for many of the unpleasant by-products of education such as the failure of pupils, poor discipline, and unsatisfactory instruction. Teachers and superintendents have pleaded for small classes as the panacea for many ills; but the results of the studies of the relation of the size of class to the achievement of pupils so far have not supported these arguments convincingly, while Dr. Carrothers has found that the number of pupils a teacher instructs does not affect her health.

Other phases of education bristle with fundamental assumptions whose effects have not been tested. Do we know that the customary organization within elementary schools is better than the platoon system which utilizes the full capacity of the school plant throughout the day? Which group of teachers is right, the one which defends the practice of assigning home work to pupils in the elementary grades or the group to which home work is an anathema? Is supervised study more beneficial than unsupervised? Do long periods of instruction yield better results than short periods in high school? The answer of any school administrator to these questions is purely a matter of opinion. No large masses of data have been gathered in support of, or in contention with, any of these problems.

J. H. M.

THE LITTLE book, *Beginner's Book in Writing and Spelling*,[1] has what seems to be an excellent idea back of it. Common objects are represented in attractive pictures, and the printed and

[1]Hall, Norman H. *Beginner's Book in Writing and Spelling*. Chicago, Hall & McCreary Company. 44 pp. 1926.

script names are given. Blanks are provided in which the child may write the words, phrases, and sentences represented by the pictures.

The execution of the idea has not been as happy as the idea itself. In the first place, children who are beginning to write should be encouraged, even required, to write large. The copy is of the size suited to the handwriting of adults. There is no reason to believe that primary children will write appreciably larger than the copy. The spaces should be at least three-fourths of an inch wide, preferably one inch to prevent cramped finger writing; and the copy should be as large as the children are expected to write.

In part of the book phrases are used and are given all of the dignity of complete sentences, for they begin with capitals and end with periods. We like to have children think and talk in complete sentences. Surely, it does not train toward this end to have them write fragments.

The illustrations, while attractive, are decidedly out of all proportion. The rat is bigger than the house right beside him. The cat, the puppy, and the pony are much the same size. The bird's egg in the nest is almost as big as the squirrel and the rabbit. To the children who know these perhaps the proper correction in perspective will be made, but to the child who is not familiar with the objects, wrong ideas will probably be built up. A different grouping of the objects would obviate much of the difficulty. There is very little objection to the vocabulary, although one might raise the question as to the need of the first-grade child learning to write "squirrel."

As indicated at the beginning, the idea is clever, and worth using. A few changes in mechanical make-up would make the little booklet an excellent adjunct to the teaching of writing and spelling in the first grade.

J. A. B.

PRACTICAL ARTS IN AN ELEMENTARY ACTIVITY CURRICULUM

SUSAN G. TROXEL
Shaker Heights Schools, Cleveland

IT WAS John Dewey who told us that our children will more easily grasp, understand, and retain their educational problems if they have the opportunity to learn through the experiences of a practical situation. Therefore, it is up to us to provide activities or experiences which will contain the principles we wish our children to learn. We now have in our schools an activity curriculum which means that many school hours are filled with experiences through which children learn by doing.

Certain equipment is necessary in a workroom for children. First, there must be a large room with movable furniture—tables and chairs instead of stationary desks and seats. For the boys, the room should have one or two small work benches with vises similar to father's and a neat tool board equipped with simple tools, such as hammers, saws, and planes. A box or cupboard filled with wood must be ready for use, and an easel with paper and paints and a jar of clay and molding boards should always be at hand. An aquarium, a row of growing plants, good pictures, and anything else to make the room enjoyable to children should also be included in the equipment.

In order to have a clear conception of the practical-arts activities one broad activity is discussed here—an activity

centering about a farm. This activity is one which has been successfully developed in many first-grade city schools. The teacher and pupils spend the day at a nearby farm which brings them in direct contact with many interesting things: cows, horses, and other animals; many types of foods—milk, corn, wheat, vegetables; trees, flowers, pebbles in the brook, clay, and soil. Any interesting material which the pupils can use in school is brought home. The next day some children will be building a farm of their own in one corner of the room; they will be using their work bench and tools. Other children will be at the easel painting pictures which the farm trip has inspired; still others will be making clay animals for their farms. Wheat will be crushed by a little hand grist mill or between stones to make flour. The whole-wheat flour which results will be made into muffins by the children. Children will learn that whole wheat contains material which makes good teeth and strong bones, and as a result they will insist upon having whole-wheat bread at home.

There are a number of other things they might be doing, but let us look at this activity from another angle. The teacher prints, on a large piece of oak-tag paper, simple dictations from the children such as these: "We visited a farm." "We saw a cow." "We saw a horse." This gives an idea of how beginning reading is handled in activity work. Because the children have had the experience, their reading will be grasped more easily. This reading will go on from day to day as the development of the farm proceeds. Their arithmetic is understood and learned as it is needed in the work they are doing. The farm study is so rich in possibilities that it may profitably continue for several months.

Besides activities which include first-hand information gained from making things, articles from a notebook or newspaper are written, library books and encyclopedias are searched for related information, oral reports are made, poems are composed, and problems are furnished for arithmetic. Thus we see from these examples that practical-arts activities are real experiences where children do things as they are done in life, where they learn the solution to life's problems in a real setting. With this method of teaching, arithmetic has a purpose, English has a meaning, and school work in general loses much of the formality of isolated subject-matter. Children understand and learn more easily because they learn through doing.

Certain criteria are necessary upon which to base the selection of activities. (1) The activity should be fundamental to life needs. (2) It should be one which will give children a broad experience. (3) It should be of interest to children. (4) It should be one which will require initiative on the part of the children. (5) It should lead the child on to larger interests. (6) It should require definite responsibility of the child.

We do not know what a child is going to be when he grows up. We do know, however, that by giving him varied experiences and freedom to do the part of an activity which interests him most, his special abilities are going to be more easily detected. The teacher in turn must not lose any time in developing these abilities through individual instruction. The greatest thing a school can do for a child is to help him do the thing which he can do best. Give the child a wide and rich experience. The greatest heritage he can obtain is the personal help of an understanding parent or teacher who sympathetically guides him into this natural unfolding of his inherent talent.

What are our schools doing to help children develop the best that is in them? One particular school has specified academic work in the morning. In the afternoon the children may do anything they wish, so long as they are

doing something that is possible in this school. They may go to the pottery or clay room, or to the laboratory room to experiment with chemicals and work on mechanical devices. They may go to the kitchen to prepare some food to take home for dinner, or they may go to the shop to do some construction work. They may remain in their home room to write a story, work on a map, or read a book. Other schools which do not have all these special rooms have arranged for a free period when children are permitted to do different things in their own room, such as clay work, wood construction, and painting. This is satisfactory for schools which carry on their activities in the individual grade room.

This new type of practical arts is rapidly replacing the old type of "busy work" or "seat work," the aim of which was merely to keep the child out of mischief so he would not annoy others in the room. Under the new type each child is so absorbed in his problem that the work of others does not disturb him. The teacher has little disciplinary trouble with a group of children who are absorbed in practical-arts activities.

How do we know that learning by doing is the best way to learn? One of the most thorough experiments along this line was made in Missouri by Collings.[1] This experiment covered a period of four years and was performed under the most exacting conditions. Tests show that the activity school is very far ahead of the old type school in academic subjects as well as in interest in school and community activities.

ON THE FIRING LINE

The City of Cincinnati voted $1,425,000 for a University of Cincinnati bond issue recently. Out of this issue a College of Education building and a library will be built.

On November 19 the new library building at the Bowling Green State Normal College was dedicated. The building and equipment represent an aggregate expenditure of $345,000.

Logan County schools are now using a report card for parents which gives a graphic presentation of their children's progress in each subject. Variations in progress from month to month are illustrated by line graphs. A red line appears between the C and D grade lines, which indicates the danger of failure if the pupil's progression line extends below it. A committee appointed by County Superintendent Glenn Drummond is working for further use of this card as a communication agency to the parents.

All school-bond issues voted upon in Butler County at the recent election were passed. Hanover Township provided $50,000 for enlarging the school; Liberty Township, $100,000 for a new school building; Madison Township, $25,000 to replace two buildings destroyed by fire; and Fairfield Township, $150,000 for a new school. The three-mill levy lost in Port Union by eight votes.

The junior high schools of Cleveland, under the leadership of Assistant Superintendent A. C. Eldredge, are experimenting with three new tentative courses of study, one in the social studies, one in mathematics, and one in general science. These courses have been developed under the detailed supervision of W. L. Connor, Bureau of Educational Research. They constitute a

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[1]Collings, Ellsworth. *An Experiment with a Project Curriculum*. New York, Macmillan Company, 1923. 346 pp.

considerable reorganization of these fields to discover what pupils are going to do and need to know how to do better.

The course in social studies draws its material mainly from the older fields of geography, history, civics, occupational information, and current events. The material is organized into approximately forty teaching units, each one being a body of material and activities collected around one of the more important objectives of the course. Another outstanding feature of the course is the emphasis placed upon the exploration and development of pupils' interests as a basis for teaching. The course is flexible enough to accommodate from three to five distinct ability groups, although specific paths have been provided for but three groups.

A STUDY OF VOCATIONAL SUCCESS OF FIFTY-THREE HIGH-SCHOOL GRADUATES

ROBERT W. EDMISTON
Lima, Ohio

THIS study was made in an attempt to get some data on vocational guidance. When a boy follows the occupation of his father he is said to have received vocational guidance from a specialist. Study in a college or a vocational school is considered as guidance when the preparation follows the line of the work pursued.

Table I shows the results of a survey carried on with fifty-three boys, all high-school graduates. In this table, high-school marks are based upon a five-point scale in which 3 is average; 1, the highest; and 5, the lowest. The table is read as follows: Boy No. 1 is following the same occupation as his father did; his high-school marks were 2, which means above the average; he had no additional years of training; and he is now in business with the same financial outlook as his father. Boy No. 3 is now following a different occupation from his father who is a farmer; his high-school marks were 2; he received one year of additional training; and he is in clerical work with a poorer financial outlook than his father. The others are read in the same way. Where two adjacent numbers are marked with an asterisk the two are brothers.

A number of facts become apparent from a study of the table. In only one of fourteen cases where the son followed the occupation of the father, does he have a poorer financial outlook than the father. Thirty-nine chose different occupations from those of their fathers', and seventeen of that number have poorer financial outlooks than had their fathers. Some of these are well up in their work but chose poorly paid occupations. Ten of the fifteen boys who left the farm indicated that their financial prospects are poorer than their fathers'. Five of these boys have positions as clerks and, with the exception of one case, they had no additional training after high-school graduation.

Thirty-three of the fifty-three boys have had further schooling and ten of these have a poorer financial outlook than their parents. No case is apparent where the financial outlook is poorer than the father's when the son has received additional training and is in the same work as his father.

In spite of the facts that tend to decrease the dependability of data which is as hurriedly gathered as this, the general trend points to the value of vocational guidance.

TABLE I

COMPARISON OF THE VOCATIONAL SUCCESS OF FIFTY-THREE HIGH-SCHOOL GRADUATES WITH THAT OF THEIR FATHERS

Graduate's Number	Occupation	High-School Marks	Additional Training (Years)	Father's Occupation	Financial Outlook Compared to Father's
(1)	(2)	(3)	(4)	(5)	(6)
1	Business man	2	.....	Same as son's	Same
2	Farmer	3	.....	Same as son's	Same
3	Clerk	2	1	Farmer	Poorer
4	Farmer	3	.....	Same as son's	Better
5	Owner telephone system	1	4	Same as son's	Better
6	Lawyer	4	3	Same as son's	Same
7	Teacher	1	5	Manager of print-shop	Same
8	Government agent	2	4	Farmer	Poorer
9	Teacher	2	4	Farmer	Better
10	Ceramist	2	4	Business man	Better
11	Factory foreman	2	2	Same as son's	Same
12	Farmer	3	.....	Same as son's	Same
13	Government inspector	2	1	Lawyer	Better
14	County auditor	3	.....	Farmer	Same
15	Clerk	3	.....	Farmer	Poorer
16	Clerk	3	.....	Farmer	Poorer
17	Shop purchasing agent	2	1	Farmer	Better
18	Clerk	4	1	Blacksmith	Poorer
19	Tanner	2	.....	Same as son's	Better
20	Bank Clerk	4	.....	Owner of cigar factory	Poorer
21	Business man	3	2	Lawyer	Same
22*	Teacher	1	2	Farmer	Poorer
23*	Teacher	3	2	Farmer	Poorer
24	Poultry dealer	3	.....	Same as son's	Same
25	Plumber	3	.....	Carpenter	Same
26	Lawyer	1	4	Clerk	Better
27*	Teacher	2	4	Farmer	Poorer
28*	Carpenter	2	.....	Farmer	Poorer
29	Clerk	2	.....	Same as son's	Same
30	Teacher	1	5	Farmer	Same
31*	Building-loan salesman	2	1	Farmer	Same
32*	Clerk	2	.....	Farmer	Poorer
33	Journalist	2	4	Doctor	Poorer
34	Lawyer	2	4	Business	Poorer
35*	Pharmacist	2	2	Laborer	Better
36*	Ceramist	2	2	Laborer	Better
37	Dealer in electrical supplies	4	.....	Laborer	Better
38	Business man	2	.....	Same as son's	Same
39	Doctor	2	6	Insurance salesman	Better
40	Accountant	1	4	Laborer	Better
41	Clerk	4	.....	Railroad agent	Poorer
42	Telephone manager	2	.....	Lightning-rod salesman	Better
43	Teacher	3	2	Laborer	Better
44	Wholesale meat dealer	3	.....	Same as son's	Same
45	Actor	2	4	Business man	Poorer
46	Child worker	2	4	Laborer	Better
47	Building-loan salesman	2	2	Skilled laborer	Same
48	Teacher	3	3	Laborer	Better
49	Editor	2	4	Politician	Better
50	Farmer	3	.....	Same as son's	Poorer
51	Teacher	1	6	Business man	Poorer
52	Doctor	3	5	Same as son's	Same
53	Optometrist	2	1	Business man	Better

* Adjacent numbers with asterisks indicates brothers.

IN PAPER COVERS

MARTIN, LILLIEN J., AND DE GRUCHY, CLARE. *Group Tests Made to Yield Individual Diagnosis.* San Francisco, Harr Wagner Publishing Company, 1927. 31 pp.

This little booklet consists chiefly of case studies, the data for which were derived from group tests and personal interviews. The authors show that group tests may give valuable data which can be used in the diagnosis of individual difficulties. Group tests may also give suggestions as to the type of treatment which the individual should receive.

Industrial Teacher Training. Pittsburgh, Pennsylvania, Pittsburgh Personnel Association, 1927. 16 pp. (Report of the Committee on Industrial Teacher Training)

This is a brief survey discussing the needs and problems of industrial teacher training, the selection of the industrial teacher, and the methods of conducting industrial teacher-training classes. Considerable space is given to what shall be included in such a course. The list of "mistakes of teachers" will be an aid to the beginning teacher of industrial work. A brief bibliography is included.

HILDRETH, GERTRUDE. *Functions of the Department of Psychological Measurement.* New York, Teachers College, Columbia University, 1927. 31 pp.

This brief monograph is a summary of the activities of the Department of Psychological Measurements at the Lincoln School of Teachers College. A list of the section headings will give the reader some idea of the content. They are: "The Administration of Testing Devices," "The Employment of Test Results in Pupil Classification," "Intensive Study of Problem Pupils," "Diagnostic and Remedial Work in the Fundamental Processes," "Supplementary Cooperative Activities," "Records and Reports," and "Research."

Guidebook to Some European School Systems. New York, Teachers College, Columbia University, 1927. 47 pp.

This guidebook is issued by the International Institute of Teachers College, Columbia University, and the Bureau of International D'Education, Geneva. It gives valuable information for one who is contemplating visiting the principal nations of Europe for the purpose of studying their educational systems. An attempt has been made to give reliable information concerning "schools characteristic of the traditions of a country or town, and experimental schools or schools showing some innovation or experimental feature."

ENGELHARDT, FRED. *Survey Report, Aurora Public Schools, Aurora, Minnesota.* Minneapolis, Minnesota, University of Minnesota, 1927. 111 pp. (Bulletin of University of Minnesota, Educational Monograph No. 13)

This is an extensive survey covering every phase of the educational program. The pubiished report gives the impression of being somewhat choppy, which is probably due to the large number of items considered. The recommendations are in line with the best established practices.

SMITH, A. V. *A Comparative Study of Certain Tests of Achievement in High School Chemistry.* The Catholic University of America, Washington, 1927. 45 pp. (Educational Research Bulletins, Vol. II, No. 5)

Four of the available chemistry tests were given to classes of pupils and the scores submitted to statistical treatment. The number of cases was quite small, and might condition the results. No one of these tests is outstanding and each has its merits. This is a good example of the critical study to which the various tests in any given field should be subjected by impartial students.

Survey of School Finance and Records in Rhode Island. Providence, Rhode Island, Public Education Service, 1927. 28 pp. (Rhode Island Education Circulars)

This survey was made by a committee of school men to secure "more comprehensive information of the practice of school officers in recording transactions and in accounting revenues and expenditures in the several towns and cities, together with such other information as may be pertinent." One of the recommendations is that all school money should pass through the town treasury. This is somewhat contrary to the general opinion held by school people, that is, that the activities of the boards of education should be entirely separate from the city government.

NICHOLS, FREDERICK G., AND OTHERS. *A New Conception of Office Practice.* Cambridge, Harvard University Press, 1927. 123 pp. (Harvard Bulletins in Education, No. 12)

This study of clerical-training needs is the result of a cooperative arrangement between the Graduate School of Education of Harvard University and the National Association of Office Managers. Fifty-four firms, located in fifteen different states and Canada and employing 34,513 office workers, made returns in the course of the study. One of the thirty-one conclusions made is that since only 10 percent of the total number of office workers included in this study are stenographers, the practice of encouraging all secondary commercial students to elect shorthand cannot be defended.

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